

7.0 Green River, Utah, Disposal Site

7.1 Compliance Summary

The Green River, Utah, Disposal Site, inspected on March 8, 2007, was in excellent condition. Unnecessary groundwater monitoring wells were decommissioned and telemetry systems were installed in several wells during 2007. Groundwater monitoring continued for the purpose of evaluating cell performance; no constituents of concern exceed their respective proposed alternate concentration limits. No cause for a follow-up or contingency inspection was identified.

7.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Green River, Utah, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site are specified in the *Long-Term Surveillance Plan [LTSP] for the Green River, Utah, Disposal Site* (DOE/AL/62350–89, Rev. 2, U.S. Department of Energy [DOE], Albuquerque Operations Office, July 1998) and in procedures established by DOE to comply with requirements of Title 10 *Code of Federal Regulations* Part 40.27 (10 CFR 40.27). These requirements are listed in Table 7–1.

Table 7–1. License Requirements for the Green River, Utah, Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Section 6.0	Section 7.3.1
Follow-up or Contingency Inspections	Section 7.0	Section 7.3.2
Routine Maintenance and Repairs	Section 8.0	Section 7.3.3
Groundwater Monitoring	Section 5.2	Section 7.3.4
Corrective Action	Section 9.0	Section 7.3.6

Institutional Controls—The 25-acre disposal site is owned by the United States of America and was accepted under the U.S. Nuclear Regulatory Commission general license (10 CFR 40.27) in 1998. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, is responsible for the custody and long-term care of the site. Institutional controls at the disposal site, as defined by DOE Policy 454.1, consist of federal ownership of the property, a disposal cell perimeter security fence, warning/no trespassing signs placed along the property boundary, and a locked gate at the entrance to the site. Verification of these institutional controls is part of the annual inspection.

7.3 Compliance Review

7.3.1 Annual Inspection and Report

The site, located southeast of Green River, Utah, was inspected on March 8, 2007. Results of the inspection are described below. Features and photograph locations (PLs) mentioned in this report are shown on Figure 7–1. Numbers in the left margin of this report refer to items summarized in the Executive Summary table.

7.3.1.1 Specific Site Surveillance Features

Access Road, Entrance Gate, Fence, and Signs—Access to the site is from either a paved road that leads south from Green River, Utah, or a paved road that leads north from U.S. Interstate Highway 70. The access route crosses state land and U.S. Army property.

Entrance to the site is through a locked steel gate in the stock fence along the paved road. Past this gate, a short track leads across state land to the disposal cell, which is enclosed within a chain-link security fence. The chain-link fence is set back between 50 and 250 feet from the site boundary. Two vehicle access gates are installed in this fence at the south and east corners of the fence line. A personnel gate is at the north corner of the fence line. The security fence and gates were in excellent condition.

One entrance sign and 17 perimeter signs are positioned on posts set along the unfenced site boundary. Perimeter sign P12 has a bullet dent but is legible; the remaining signs were in excellent condition.

Site Markers and Monuments—The two granite site markers, 11 boundary monuments, and three survey monuments were in excellent condition.

Monitor Wells—Groundwater monitor wells are present at the site as described in Section 7.3.4. The wells were secure and in excellent condition.

7.3.1.2 Transects

To ensure a thorough and efficient inspection, the site was divided into three areas referred to as transects: (1) the disposal cell and adjacent area inside the security fence; (2) the site perimeter between the security fence and the site boundary; and (3) the outlying area.

The area inside each transect was inspected by walking a series of traverses. Within each transect, the inspectors examined specific site surveillance features, drainage structures, vegetation, and other features. Inspectors also looked for evidence of settlement, erosion, or other modifying processes.

Disposal Cell and Adjacent Area Inside the Security Fence—The 6-acre disposal cell was completed in 1989. The slopes of the disposal cell cover are armored with basalt rock. The cell cover was in excellent condition. The riprap-filled apron trench along the base of the disposal cell on all sides was in excellent condition (PL-1).

Site Perimeter Between the Security Fence and the Site Boundary—Rills and gullies are present on the west side of the property but do not pose a threat to the integrity of the cell and currently are not impacting any site surveillance features. Rills and gullies are also present along the escarpment northeast of the disposal cell in the area between boundary monument BM-7 and survey monument SM-3 (PL-2). Maximum gully depth in this area is approximately 3 feet. The rill and gully erosion poses no threat to the integrity of the disposal cell but could eventually damage perimeter signs and boundary monuments.

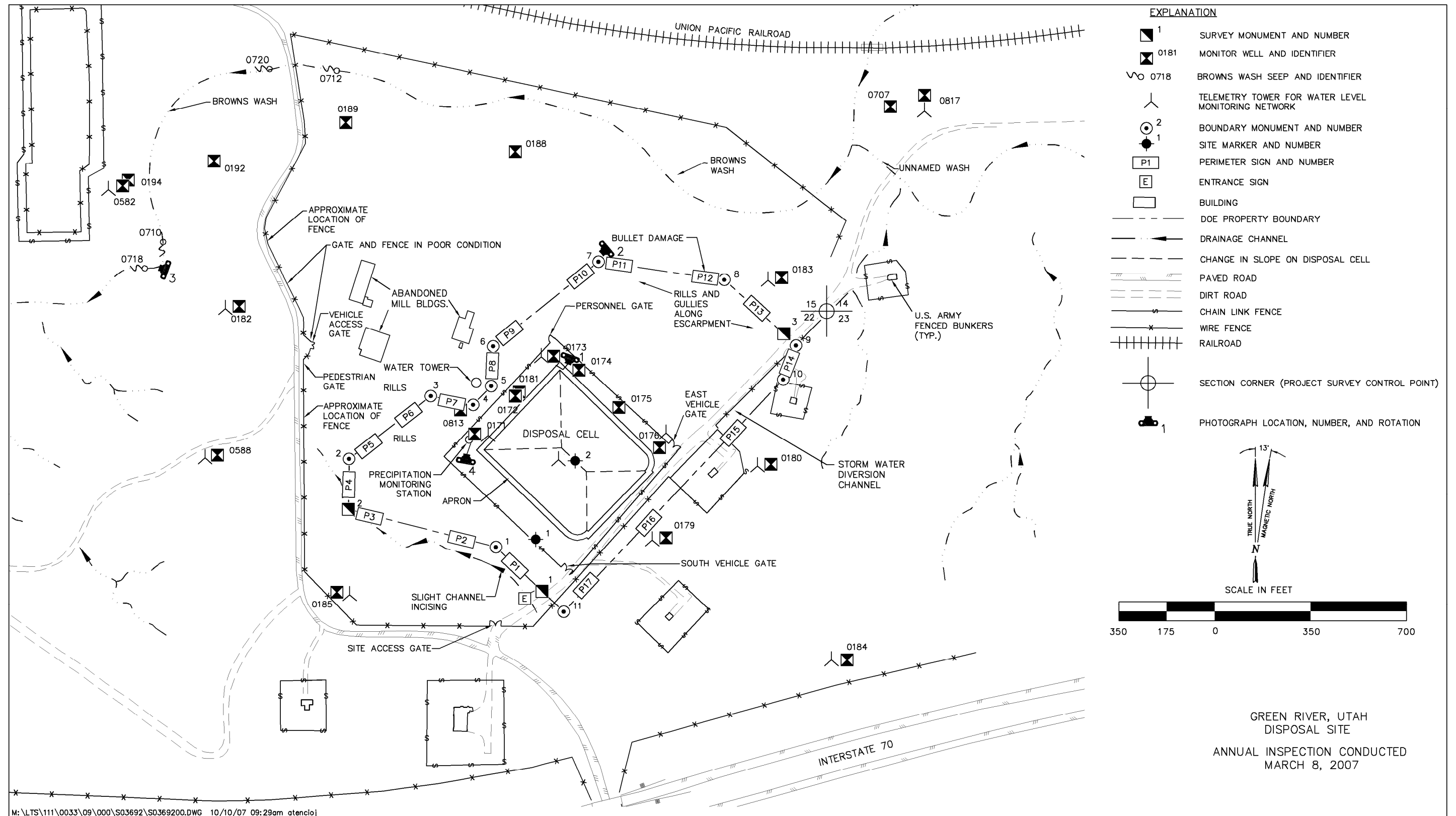


Figure 7-1. 2007 Annual Compliance Drawing for the Green River, Utah, Disposal Site

A barbed-wire stock fence on the surrounding state-owned property is in poor condition, and an access gate through the fence to abandoned mill buildings northwest of DOE property was heavily damaged and open. Tracks indicate that vehicles enter the gate and cross DOE property to access areas northeast of the site. However, there was no evidence of vandalism to site surveillance features. Because DOE does not have a responsibility to maintain the barbed-wire fence and gate, trespassing onto DOE property is difficult to control. DOE will continue to monitor for evidence of vandalism at the site.

Outlying Area—The area extending outward from the site for a distance of 0.25 mile was checked for signs of erosion, development, or other disturbance that might affect site security or integrity. Areas of erosion noted during recent and previous inspections include the natural drainage southwest of the site and rills and gullies northwest of the water tower. Minor erosion continues but currently does not pose a threat to the integrity of the disposal cell or site surveillance features.

Abandoned buildings associated with milling activities at the Green River processing site are located northwest and upwind of the DOE property. The buildings are in a severe state of disrepair, and debris (e.g., roofing materials, siding, trash) tends to be blown from the buildings onto DOE property. Accumulation of building materials blown onto DOE property was not significant, but will continue to be monitored and debris will be removed as necessary.

The alluvium in the bottom of Browns Wash was moist, and very small pools were present at several seep locations at the time of the annual inspection (PL-3). These seeps have been identified as potential discharge locations for the contaminated Middle Sandstone Unit aquifer of the Cedar Mountain Formation (the aquifer is contaminated under the disposal site from former processing site operations and disposal cell construction). Extensive field observations indicate that many of the small ephemeral pools in Browns Wash are the result of recent runoff in the wash and dewatering of the alluvium. However, observations during sub-freezing temperatures in January and February 2007 indicated slight but steady flows at several documented seep locations. The warm water, presence of green algae at these locations, and poor water quality suggests that the seep water is derived from vertical fractures emanating from deeper aquifers such as the Jurassic Morrison Formation (the Middle Sandstone Unit is not present under the principal seep at location 0718). Most of the seep locations were dry when the site was visited in September 2007.

7.3.2 Follow-Up or Contingency Inspections

DOE will conduct follow-up inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition, or (2) DOE is notified by a citizen or outside agency that conditions at the site are substantially changed.

No follow-up or contingency inspections were required in 2007. The site was visited several times in 2007 to supervise telemetry installation and well decommissioning activities, and to monitor the condition of Browns Wash and its seeps.

7.3.3 Routine Maintenance and Repairs

No routine maintenance or repairs were performed at the disposal site in 2007. However, telemetry systems to monitor groundwater levels were installed in 12 wells of the monitoring network, and chain-link fence enclosures were constructed around four of the telemetry towers to prevent vandalism. Also, 12 unneeded monitor wells were decommissioned.

7.3.4 Groundwater Monitoring

7A The LTSP stipulates a cell-performance groundwater-monitoring network of four point-of-compliance (POC) wells (MW-0171, MW-0172, MW-0173, and MW-0813). Because of poor completion characteristics, MW-0172 is no longer being sampled and a newer well adjacent to it (MW-0181) is being monitored instead. Based on a draft *Preliminary Final Ground Water Compliance Action Plan for the Green River, Utah, (UMTRCA Title I) Disposal Site* (GCAP) and discussions with the State of Utah, DOE is monitoring MW-0176 and MW-0179 as POC wells also. Groundwater levels are monitored in the two Cedar Mountain Formation aquifers of concern (Middle Sandstone and Basal Sandstone units).

7B The draft GCAP includes both the disposal site and the former processing site, so it addresses compliance to both Subparts A and B of 40 CFR 192. Therefore, the monitoring network includes non-POC wells completed in the Browns Wash alluvium for best management practice monitoring (MW-0188, MW-0189, MW-0192, and MW-0194). These wells are in, and downgradient of, an area where tailings had been stored on the alluvial plane. The low-yield groundwater in the alluvium was contaminated during processing and tailings-storage activities, and is recommended for application of supplemental standards based on a classification of limited use groundwater. The wells will be sampled as a best management practice to track the migration of contaminants out of the alluvium. Following concurrence of the GCAP, the LTSP will be revised to incorporate the accepted groundwater compliance strategy.

The purpose of monitoring the POC wells is to evaluate the performance of the disposal cell. In accordance with the draft GCAP, groundwater samples are collected annually (beginning in June 2007) and are monitored for four target analytes—arsenic, nitrate, selenium, and uranium. Nitrate and uranium are indicator constituents, and arsenic and selenium are monitored because of concentrations that exceed U.S. Environmental Protection Agency maximum concentration limits (MCLs) provided in 40 CFR 192 Table 1 of Subpart A. Sulfate is no longer analyzed because there is currently no primary drinking water standard for that constituent.

Based on the evaluation of several years of analytical data and associated risk, the alternate concentration limits (ACLs) listed in Table 7-2 have been proposed to NRC and the State of Utah in the draft GCAP. If accepted, these proposed ACLs will be applicable to all point-of-compliance wells.

Samples were collected quarterly for 3 years beginning in 1998 with the provision that monitoring requirements would be reevaluated in 2001 to determine if contaminant levels in groundwater decreased to levels that existed prior to construction of the disposal cell. The evaluation report concluded that concentrations were within a reasonable range of compliance relative to the proposed concentration limits provided in the LTSP. However, it is understood that the presence of preexisting processing-related groundwater contamination in the disposal

cell vicinity complicates the assessment of disposal cell performance. In addition, changes in concentration levels unrelated to disposal cell performance may occur at the site as a result of preexisting contamination.

Table 7–2. Proposed Alternate Concentration Limits for Point-of-Compliance Wells at the Green River, Utah, Disposal Site

Constituent	MCL (mg/L)	Proposed ACL (mg/L)
Arsenic	0.05	5.0
Nitrate (as N)	10	1,000
Selenium	0.01	1.0
Uranium	0.044	4.4

Key: ACL = alternate concentration limit; MCL = maximum concentration limit; mg/L = milligrams per liter; N = nitrogen

Quarterly monitoring of the original four point-of-compliance wells continued through June 2007. Through development of the draft GCAP, risk analyses have determined there is no unacceptable risk to human health and the environment as a result of site-related contamination in groundwater in the vicinity of the Green River, Utah, Disposal Site because the groundwater is not used and the river water is unaffected by site contaminants. Therefore, DOE determined that there was no health or cost benefit associated with continuing quarterly monitoring, so annual monitoring has been implemented.

- 7C In 2007, 12 unneeded monitor wells were decommissioned. These wells were completed in non-aquifer units of the Cedar Mountain Formation and in Browns Wash alluvium north of the wash. These wells had not been sampled for several years and provided no benefit to the groundwater-monitoring program at the site.

Point-of-Compliance Well Monitoring—Analytical results for the June 2007 sampling event at the proposed POC wells are provided in Table 7–3. Time-concentration plots for the period 1998 through June 2007 for the four target analytes—arsenic, nitrate, selenium, and uranium—are shown on Figures 7–2 through 7–5.

Table 7–3. Analytical Results for POC Wells at the Green River, Utah, Disposal Site

Monitor Well	Arsenic (mg/L)		Nitrate as N (mg/L)		Selenium (mg/L)		Uranium (mg/L)	
	ACL	Sample Result	ACL	Sample Result	ACL	Sample Result	ACL	Sample Result
0171	5.0	0.0014	1,000	56	1.0	0.21	4.4	0.093
0173	5.0	0.0024	1,000	260	1.0	0.11	4.4	0.011
0176	5.0	0.00065	1,000	54	1.0	0.82	4.4	0.0024
0179	5.0	0.00073	1,000	19	1.0	0.31	4.4	0.18
0181	5.0	0.0019	1,000	91	1.0	0.014	4.4	0.013
0813	5.0	0.084	1,000	0.01	1.0	0.0009	4.4	0.017

Key: ACL = proposed alternate concentration limit; mg/L = milligrams per liter; N = nitrogen

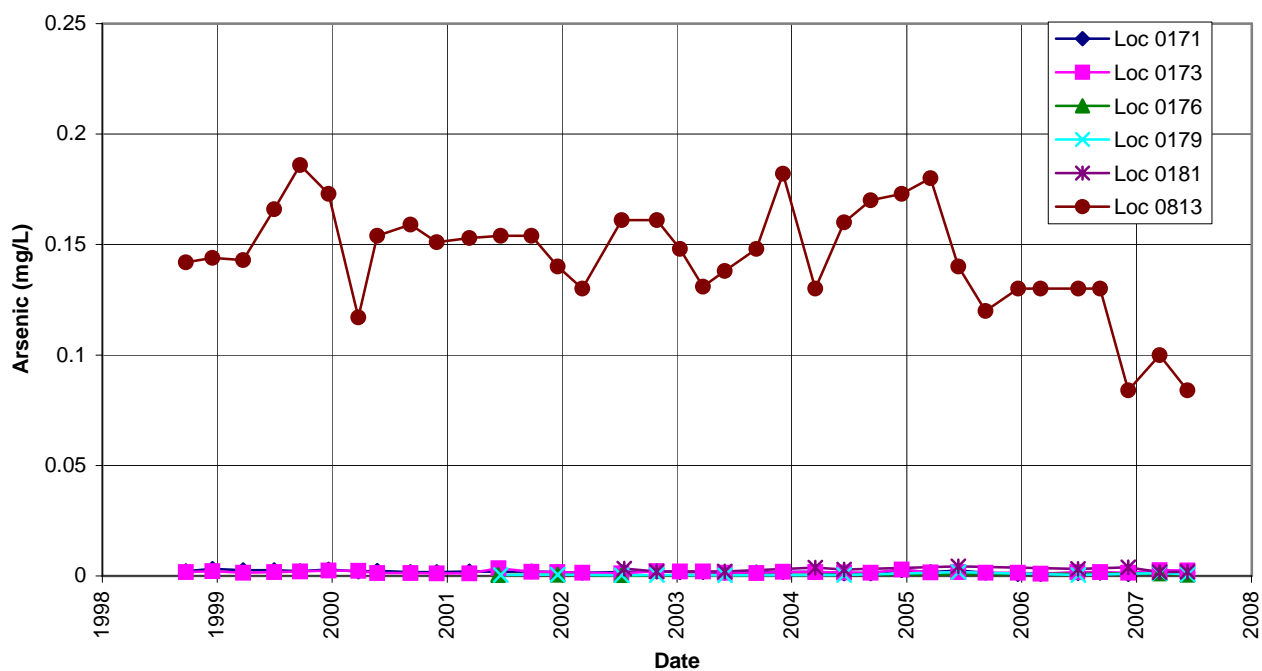


Figure 7-2. Time-Concentration Plots of Arsenic in Groundwater at the Green River, Utah, Disposal Site

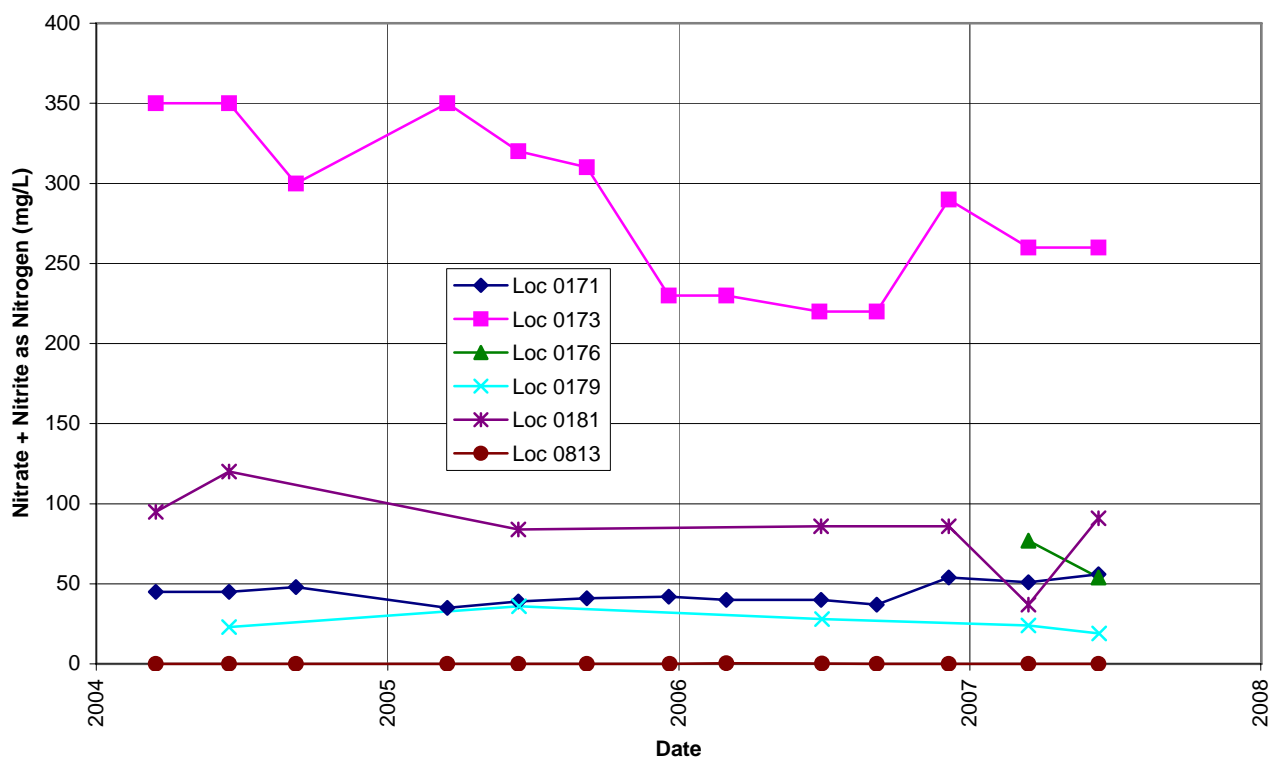


Figure 7-3. Time-Concentration Plots of Nitrate in Groundwater at the Green River, Utah, Disposal Site

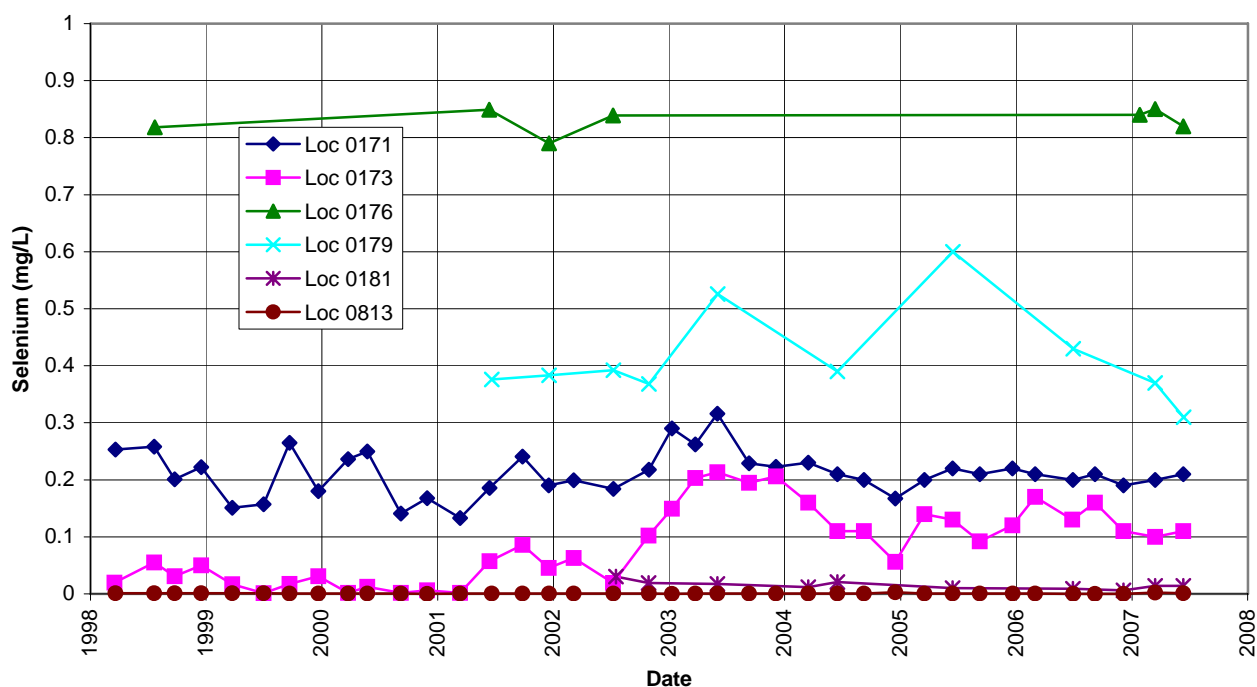


Figure 7-4. Time-Concentration Plots of Selenium in Groundwater at the Green River, Utah, Disposal Site

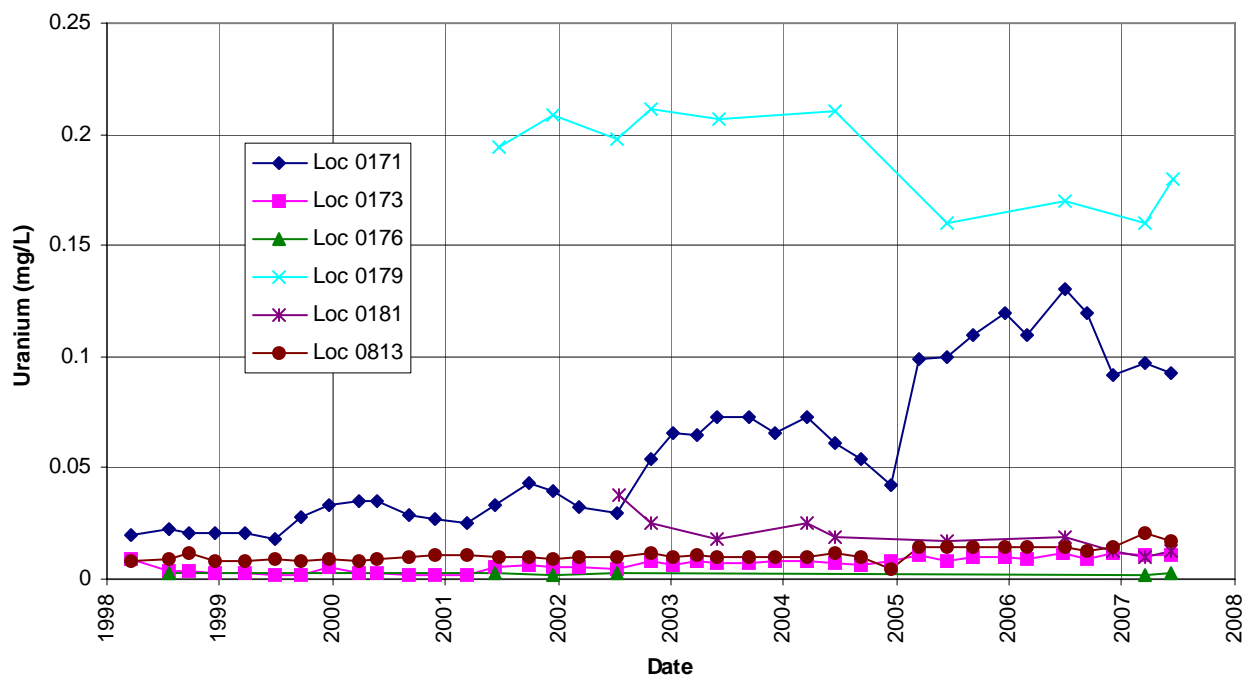


Figure 7-5. Time-Concentration Plots of Uranium in Groundwater at the Green River, Utah, Disposal Site

Arsenic concentrations in groundwater remain below the MCL of 0.05 mg/L in all POC wells except MW-0813, and considerably below the proposed ACL of 5.0 mg/L in all POC wells. In well MW-0813, levels have exceeded the MCL over the entire sampling period (Figure 7-2) but are substantially below the proposed ACL. The results for this well indicate an apparent downward trend in the last few years.

Nitrate concentrations have been measured as nitrate plus nitrite as nitrogen since early 2004 (prior to that time, nitrate was measured as NO₃). Concentrations have continued above the MCL of 10 mg/L in all POC wells except MW-0813, but are considerably below the proposed ACL of 1,000 mg/L in all wells; values for MW-0813 continue near the laboratory detection limit (Figure 7-3). An overall downward trend has been occurring in well MW-0173, and an apparent slight upward trend is occurring in well MW-0171.

Except for well MW-0813, which remains near the laboratory detection limit, selenium concentrations in groundwater continued above the MCL of 0.01 mg/L but below the proposed ACL of 1.0 mg/L in the POC wells (Figure 7-4). Selenium concentrations have been decreasing in well MW-0179 for the past two years; otherwise, no trends are apparent in the POC wells.

Uranium concentrations in groundwater remain below the MCL of 0.044 mg/L and considerably below the proposed ACL of 4.4 mg/L, and continue to remain essentially constant in wells MW-0173, MW-0176, MW-0181, and MW-0813. The highest uranium concentrations continue to occur at well MW-0179, which is apparently upgradient from the disposal cell; the cause of the elevated concentrations has not been determined. At well MW-0171, concentrations exceed the MCL and continue to exhibit an overall upward trend even though the last three measurements have been less than its peak concentration (Figure 7-5). Because uranium is the only constituent of concern in well MW-0171 that has indicated an upward trend, no conclusions regarding the cause of the trend have been reached at this time.

7D Groundwater Level Monitoring—Groundwater levels in several monitor wells adjacent to the disposal cell have been measured manually since 1991, and continually with down-hole data loggers since 1999. Data loggers are currently present in 13 wells, and a telemetry system was installed in 2007 to transmit the continuous water level monitoring data to the DOE office in Grand Junction, Colorado (PL-4). The purpose of continuous monitoring is to confirm persistence of the upward hydraulic gradient in the two Cedar Mountain Formation aquifers and to evaluate flow directions in the aquifers in the vicinity of the disposal cell.

Water level hydrographs of the POC wells, completed in the Middle Sandstone Unit of the Cedar Mountain Formation, indicate that an overall decrease in the groundwater elevation of approximately 2 feet occurred from 1998 through 2004, followed by an increase of approximately 8 feet since then (Figure 7-6). This rapid increase in groundwater elevation adjacent to the cell may be the result of local recharge. Numerous heavy rainfall events have occurred at the site in the last couple of years and, apparently, runoff from the disposal cell slopes has pooled in the apron trench and then seeped downward through vertical fractures in the Cedar Mountain Formation and into the Middle Sandstone Unit aquifer. Erroneous manual measurements, likely due to equipment problems, occurred on several occasions (continuous measurements indicated essentially no change at those times); these measurements are not shown on Figure 7-6.

Preliminary water level monitoring data from the entire network verify that an upward hydraulic gradient exists in the Cedar Mountain aquifers; therefore, contaminants in the Middle Sandstone Unit are unlikely to migrate downward into the uncontaminated Basal Sandstone Unit. The continuous monitoring data will be evaluated to determine flow directions of the aquifers and if the flows indicate seasonal variations or are influenced by groundwater mounding under the disposal cell.

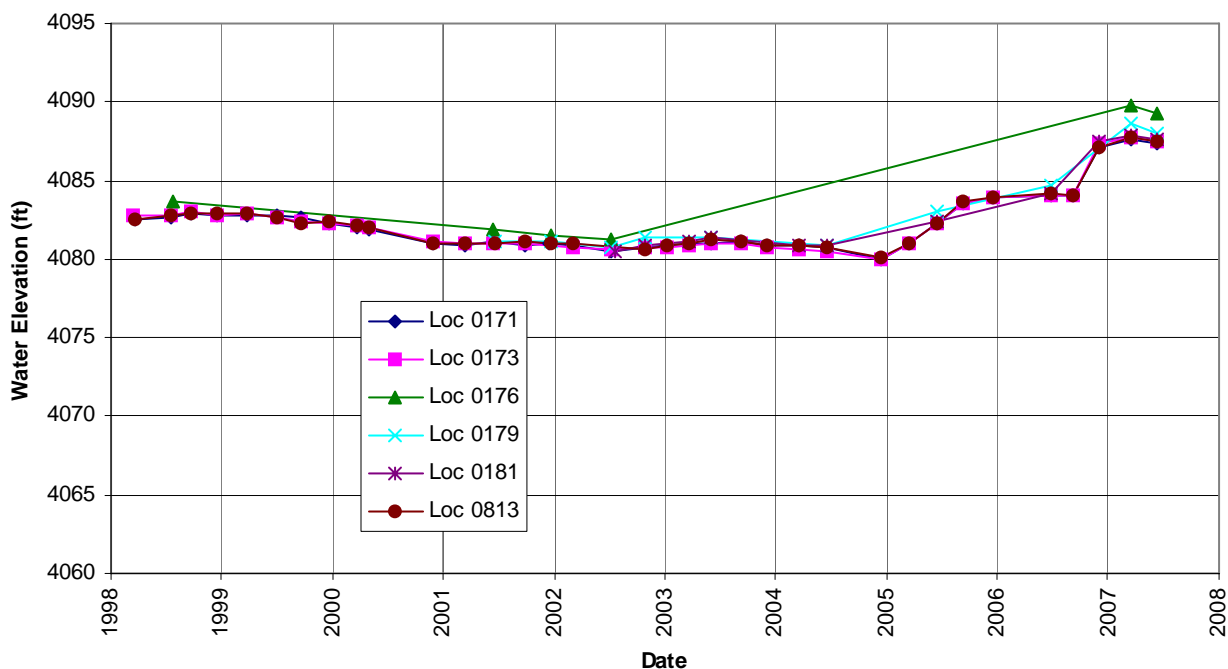


Figure 7-6. Groundwater Elevations at the Green River, Utah, Disposal Site

Browns Wash Alluvial Well Monitoring—Analytical results for the June 2007 sampling event at the wells completed in the Browns Wash alluvium are provided in Table 7-4. Because of the application of supplemental standards, ACLs do not apply to the alluvial groundwater. Contaminants are expected to eventually flush out of the alluvium as the groundwater slowly migrates toward the Green River alluvial aquifer and the Green River. Except for selenium, the highest concentrations are present in well MW-0194, which is the farthest downgradient alluvial well from the former processing site and tailings storage area.

Table 7-4. Analytical Results for the Browns Wash Alluvial Wells at the Green River, Utah, Disposal Site

Monitor Well	Arsenic (mg/L)	Nitrate as N (mg/L)	Selenium (mg/L)	Uranium (mg/L)
0188	0.00036	62	0.034	0.068
0189	0.00058	87	0.026	0.36
0192	0.00039	180	0.084	0.51
0194	0.0038	930	0.033	4.4

Key: mg/L = milligrams per liter; N = nitrogen

7.3.5 Surface Water Monitoring

7E It is assumed that the ultimate point of exposure for the groundwater in the Middle Sandstone Unit of the Cedar Mountain Formation is the Green River via seepage through vertical fractures in the overlying formations. If this occurs, the locations of potential risk have been considered to be in a backwater area at the mouth of Browns Wash and the Green River itself. Risk analyses have determined, however, that there are no unacceptable risks to potential receptors (human or ecological) at these locations. As a best management practice, DOE monitors the surface water at these two locations to verify that any contaminated groundwater would not adversely affect ecological receptors near the confluence of Browns Wash and the Green River. Proposed surface water standards, in accordance with Utah Rule R317-2, Table 2.14.2, are provided in Table 7-5.

Table 7-5. Proposed Surface Water Standards for the Browns Wash and Green River Sampling Locations

Constituent	Surface Water Standard (mg/L)
Ammonia as N	About 0.5 to 1.0 (pH and temperature dependent)
Arsenic	0.340 (1-hour) 0.150 (4-day)
Nitrate as N	4
Selenium	0.0184 (1-hour) 0.0046 (4-day)
Uranium	No Standard

Key: mg/L = milligrams per liter; N = nitrogen

A location in the Green River immediately downstream of the mouth of Browns Wash (SW-0846), and a location in the backwater area of Browns Wash (SW-0847) are sampled annually. Analytical results for the June 2007 sampling event are provided in Table 7-6. To date, no surface water sample results have exceeded the standards, and there is no indication that the surface water quality at these locations has been degraded by disposal site contamination.

Table 7-6. Analytical Results for the Surface Water Locations at the Green River, Utah, Disposal Site

Location	Ammonia as N (mg/L)	Arsenic (mg/L)	Nitrate as N (mg/L)	Selenium (mg/L)	Uranium (mg/L)
0846 (Green River)	0.1	0.0012	0.01	0.00051	0.0016
0847 (Backwater)	0.1	0.0015	0.01	0.00049	0.0027

Key: mg/L = milligrams per liter; N = nitrogen

7.3.6 Corrective Action

Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192.

No corrective action was required in 2007.

7.3.7 Photographs

Table 7–7. Photographs Taken at the Green River, Utah, Disposal Site

Photograph Location Number	Azimuth	Description
PL–1	200	Perimeter road along the disposal cell apron.
PL–2	230	Gullies and rills near boundary monument BM–7.
PL–3	290	Browns Wash seep 0718 at the main Cedar Mountain Formation outcrop area.
PL–4	10	Telemetry tower and precipitation gauge at monitor well MW–0171.



GRN 3/2007. PL-1. Perimeter road along the disposal cell apron.



GRN 3/2007. PL-2. Gullies and rills near boundary monument BM-7.



GRN 3/2007. PL-3. Browns Wash seep 0718 at the main Cedar Mountain Formation outcrop area.



GRN 3/2007. PL-4. Telemetry tower and precipitation gauge at monitor well MW-0171.

End of current section.